PATENT SPECIFICATION

374,918

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COMPLETE SPECIFICATION.

Improvements in or relating to Grinding or Abrading Machines.

We CLAUS JUNGE, of 28, Kaiserallee, Berlin-Mariemfelde, Germany, a citizen of the German Republic, and FRITZ WERNER AKTIENGESELLSCHAFT, a Joint Stock Company existing under the German Laws, of Berlin-Marienfelde, Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to grinding or abrading machines of the kind usually employed for the mass production of repetition work and which are provided with means to effect the commencement of the feeding movement of the grinding disc when the effective operative surface of the grinding disc is at a definite distance from the predetermined dimension of the workpiece and independently of any reduction in diameter of the grinding disc which may have taken place due to wear or truing up of the disc.

In such machines as hitherto constructed, any reduction in diameter of the grinding disc was compensated for by means of a cam ring member which was used for both the coarse and fine feeds, the compensation movement being effected by means of a worm and toothed gear. It was therefore necessary to employ two sets of mechanism, one for the feed and one for the compensation and also an electrical release device to actuate the compensation gear, the amount of the coarse and fine feed of the grinding disc being determined by means of the cam.

In a further construction previously proposed having this object in view, the apparatus was operated by means of an epicyclic gear and was dependent upon the position of a truing diamond.

According to the invention a ratchet wheel is provided for effecting the total feed inclusive of the travel corresponding to the wear of the grinding disc, the ratchet wheel being loosely coupled with a limiting member movable between two adjustable stops in such manner that said limiting member on contact with one stop releases the coupling, thereby permitting an independent further rotation of the ratchet wheel corresponding to the wear of the grinding disc, whilst upon the return movement of the ratchet wheel, the coupling with the limiting member is again established permitting a backward rotation of the ratchet wheel by an amount determined by the position of the stops.

In order that the invention may be clearly understood reference is directed to the accompanying drawings wherein:—

Figure 1 diagrams I—IV show diagrammatically the conditions of grinding with coarse and fine feed, when compensation for the reduction in diameter of the grinding disc does not take place. Figure 1 diagram V shows the condition with compensation for the wear of the grinding disc according to the invention.

Figures 2 to 4 illustrate one method of carrying the invention into effect for ensuring a uniform feed wherein Figure 2 is a horizontal section, Figure 3 is a vertical section on the line A—A in Figure 2, and Figure 4 is a rear end elevation of a portion of the apparatus shown in Figure 2.

Figures 5 to 7 illustrate a further example employed for obtaining a coarse and fine feed wherein Figure 5 is a horizontal section, Figure 6 is a section on the line B—B in Figure 5, and Figure 7 is a rear end elevation of a portion of the apparatus shown in Figure 5.

Figure 8 is a horizontal section and Figure 9 a sectional rear elevation of a further modified form of apparatus.

In the two examples of means carrying the invention into effect as shown in Figures 2 to 4 and Figures 5 to 7 the grinding disc is moved forward automatically in known manner by means of the rotating spindle 5 which carries a crank disc 6, motion being transmitted through the medium of a connecting rod 7 to the lever 8 which in turn transmits motion by means of a pawl 9 to a ratchet wheel 10. The ratchet wheel 10 is keyed to a spindle 11, the spindle also carrying a toothed wheel 12 keyed thereto which drives a further toothed wheel 13 mounted rigidly upon a threaded shaft 1. The shaft 1 is in screw threaded engagement

with a correspondingly threaded nut (not shown) which carries or is associated with the spindle of the grinding disc. Upon the spindle 5 being given a rotational movement of 360° at definite intervals of time, the threaded shaft 1 will be turned about its axis thereby moving the grinding disc towards the work with a step by step movement. The grinding disc may also be fed forwardly or retracted from the work by hand also in known manner by means of a hand wheel carried by a shaft 2 carrying a bevel gear wheel 3 which engages a further bevel gear wheel 4 mounted on the shaft 1. Means is provided whereby rotation of the spindle 5 is stopped automatically on the grinding disc reaching the predetermined size of the work by means of a finger or the like resting on the work.

In Figure 1, diagram 1, *w* indicates the surface of the article in the unground or raw state, the lines *x*, *y*, *z*, *a*, correspond to the layers of material removed during coarse feed, and the lines *b*, *c*, *d*, *e*, *f*, to the layers ground off with the fine feed, and *f* is the surface of the finished article. In consequence of the reduction of diameter of the grinding disc, the effective grinding surface gradually recedes, and at the commencement of the fine feed—with uniform return of the feed shaft after the completion of an article—would for successive articles stand at a_1, a_2, a_3. Figure 1, diagrams II, III and IV. There are consequently increasingly more grinding stages necessary, and the time for the production of the finished article is considerably increased with the number of the articles. This disadvantage is prevented by employment of the apparatus described below.

In the example of construction according to Figures 2—4, the ratchet wheel 10 is first connected through the spindle 11 with the two toothed wheels 14, 15 having teeth on the circumference disposed in opposite directions (see Figure 4). The teeth engage pawls 16, 17 which are pivotally mounted upon a disc 18 by a pin 19, and are kept in engagement with the corresponding circumferential teeth by a spring not shown. If now the ratchet wheel 10 is rotated in the feed direction, that is, in the direction of the arrow 20, then by means of the ratchet wheel 15 and pawl 16, the disc 18 is carried round until the pawl 16 bears against a fixed stop 21. By means of an inclined bearing surface 21*a*, the pawl is then lifted from the teeth. In this position of the feed spindle, the predetermined size should be approximately reached; if this, in consequence of the wear of the grinding disc is not the case, the spindle 5 rotates further and carries with it the ratchet wheels 14, 15 as the pawl 16 is out of engagement, and the pawl 17 in this direction of rotation corresponding to the feed slides over the ratchet teeth and the disc 18 remains stationary. The further rotation of the feed shaft 1 and therewith the ratchet wheels 14, 15 takes place until the shaft 5 is stopped after reaching the predetermined size.

Before working on the fresh article, it is then only necessary to fix the position of the adjustable stop 22 corresponding to the return of the spindle 1 necessary for the sufficiently free positioning of the grinding disc. If the grinding disc and with it the limiting member 18 are returned by hand, that is, by means of 2, 3, 4, 1, 13, 12, 11, 14, 17, 19, until the pawl 17 bears against the stop 22, one can be sure that, on the one hand, the grinding disc is brought back by the amount necessary for the next article, and by no more, and on the other hand that the effective surface of the disc is automatically moved forward by such an amount as corresponds to the previous wear; in other words, the effective surface of the grinding disc is again at the same distance from the predetermined size *f* as in the case of the previous article.

The second example of construction, Figures 5—7, differs from the first by a supplementary device which permits of working first with coarse, and then at a predetermined distance from the work, with a fine feed, allowing the latter in the sense of the main idea of the invention to always commence at a definite distance away of the active surface of the disc from the predetermined size. The same parts are indicated in Figures 2—7 with the same reference numbers; Figure 6 showing a section through the line BB of Figure 5.

According to this construction, there is rotatably arranged on the spindle 11, a lever 23 on which is fixed, in the known manner, a shutter 24 arranged concentrically to the ratchet wheel 10 and covering the toothed circumference thereof. When the lever 23 is rotated counter-clockwise (arrow 20) then the shutter slides between the ratchet wheel and the pawl 9, so that the pawl which previously in its backward and forward movement covered a maximum of about 8 teeth, now only covers, according to the position of the shutter, only 7, 6, 5 down to 1, or even half a tooth. It is thus possible by displacing the shutter, to limit the effective stroke of the pawl and thus to change from a coarse to a fine feed.

The displacement of the shutter is, according to the invention, controlled by a

cam piece 25 connected with the disc 18. On the circumference of the cam disc bears a roller 29 which is fixed on a lever 27 capable of rocking about the fixed axis of rotation 26. The other end of the lever is connected by a rod 28 with the lever 23. The method of working is as follows:—

At the commencement of the feed, the roller 29 rests on the concentric part 18^{I} of the cam. On the rotation of the parts 10, 15, 14, 18 no action on the lever 23 takes place; the whole stroke of the pawl 9 is effective, thus coarse feeding takes place each time by about eight teeth—corresponding to Figure 1: *w—x—y—z*.

When the cam disc in its rotation has reached the position shown, the roller begins to rise on the cam part 18^{II}, and to move forward the shutter 24 in counter-clockwise direction. By suitable selection of the rise of the cam, a result can be so obtained that the pawl 9 covers a progressively smaller number of teeth, the coarse feeding thus passing gradually into fine feeding—(see Figure 1)—diagram V: z_1, z_2, and so on

When the roller reaches the upper and again concentric part of the cam 25, the shutter 24 is no longer moved forward. The fine feed is maintained at a predetermined amount:—(see Figure 1) diagram I, *a*, *b*, *c*, *d*, *e*, *f*.

If after a number of grinding cuts, the number of which can be exactly predetermined by the adjustment of the cam, the pawl 16 strikes against the stop 21, the pawl is lifted out and the disc 18 is stopped; the fine feed can, however, as above described, still proceed by the—practically negligible—amount of the grinding disc wear, until the spindle 5 after reaching the predetermined size, is automatically stopped.

The result is here again attained that the active grinding disc surface is moved forward as compared with the fixed stop 21, by the amount of wear. If the parts 2, 3, 4, 1, 13, 12, 11, 10, 14, 15 are rotated clockwise, that is, in the reverse direction, until the pawl 17 bears against the stop 22 limiting such backward movement, assurance is given that the coarse and the fine feed for the next article treated will begin at the same point in the travel of the grinding disc towards the predetermined size. In the contrary case—with constantly uniform returning angle of the feed shaft—the commencement of the fine feed would gradually work back more and more into the coarse feed zone as described at the outset.

In the modified construction of apparatus illustrated by Figures 8 and 9 the ratchet wheels 14 and 15 employed in the constructions previously described are replaced by friction discs 30 and 31 disposed on opposite sides of a disc or plate 32 which approximates to the member 18 previously described, the disc 32 carrying a stop 34 in lieu of the pawl 16 and which is adapted to engage the fixed stop 21 to limit the movement of the disc 32 in the one direction. The return movement of the disc 32 to its initial position is limited by the adjustable stop 22 which engages the upper end of the stop 34. The discs 30, 31 and 32 are urged into engagement by means of the coiled spring 33. A shutter 24 is provided which operates in conjunction with the pawl 9 in a similar manner to that previously described. A magnetic clutch 35 may be provided for putting the shaft 5 in driving connection with a driving shaft 5^{a}.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. Apparatus for use with a grinding or abrading machine for the mass production of repetition work provided with automatic feed of the grinding disc the feed of which, on the work reaching the predetermined size, is terminated by means of a finger or the like resting on the work, and is thus independent of the amount of its wear, the grinding wheel being always returned from the work by the same amount, wherein a ratchet wheel is provided for effecting the total feed inclusive of the travel corresponding to the wear of the grinding disc, the ratchet wheel being loosely coupled with a limiting member movable between two adjustable stops in such manner that said limiting member on contact with one stop releases the coupling, thereby permitting an independent further rotation of the ratchet wheel corresponding to the wear of the grinding disc, whilst upon the return movement of the ratchet wheel, the coupling with the limiting member is again established permitting a backward rotation of the ratchet wheel by an amount determined by the position of the stops.

2. Apparatus as in claim 1, wherein the coupling provided between the ratchet wheel and the limiting member consists of a pair of ratchet wheels provided with oppositely directed circumferential teeth, and two pawls pivotally mounted on a disc forming the limiting member and engaging the teeth of the pair of ratchet wheels, of which one pawl upon the feed movement of the apparatus abuts against a stop and is lifted out of the circumferential teeth of one ratchet wheel of the pair, thereby interrupting rotation of the disc, whereupon the ratchet wheel moves for-

ward the grinding disc by the amount of its wear until reaching the predetermined size of the work, the other pawl on the return movement contacting with an adjustable stop which limits the rotation of the disc and thus of the ratchet wheel upon the reverse movement of the apparatus.

3. Apparatus as in claim 1 wherein the ratchet wheel and limiting member are connected together frictionally, whereby upon the limiting member engaging the stop for restricting its forward movement the frictional connection will be overcome, thereby allowing of further movement of the ratchet wheel without further corresponding movement of the limiting member taking place.

4. Apparatus as in claim 1, 2 or 3, wherein the feed movement is sub-divided into a coarse and a fine feed, by means of a cam disc which displaces on the change from coarse to fine grinding a shutter provided in the known manner between the ratchet wheel and a pawl and controlling the duration of the pawl engagement, so that the fine feed always commences at a definite point in the travel of the grinding disc towards the predetermined size of the work.

5. Apparatus as in claim 4, wherein the cam disc produces a gradual displacement of the shutter, to effect a gradual reduction of the effective partial stroke of the pawl up to the amount corresponding to the fine feeding.

6. The improved apparatus for controlling the feed of automatic grinding or abrading machines constructed, arranged and adapted to operate substantially as described with reference to Figures 2 to 4 or Figures 5 to 7 or Figures 8 to 9 of the accompanying drawings.

Dated this 9th day of March, 1931.

HASELTINE, LAKE & Co.,
28, Southampton Buildings, London, England, and
19—25, West 44th Street, New York, U.S.A.,
Agents for the Applicants.

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Fig. 1.

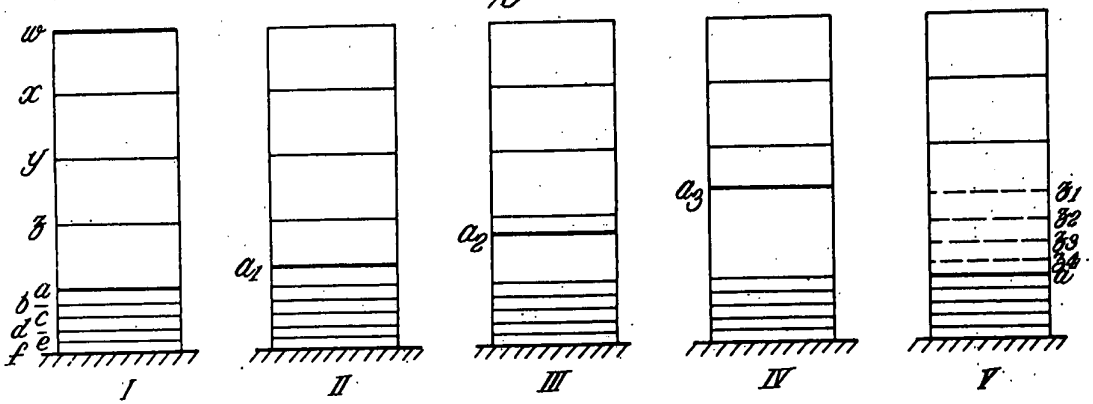


Fig. 2.

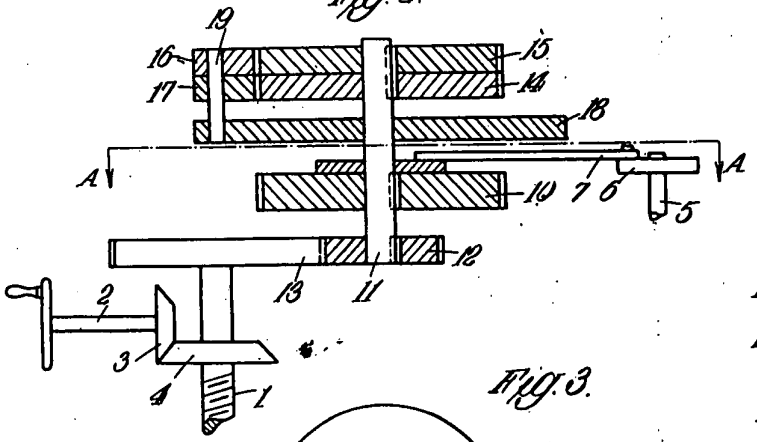


Fig. 3.

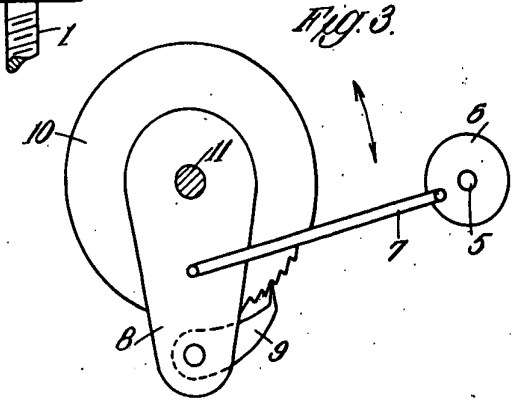
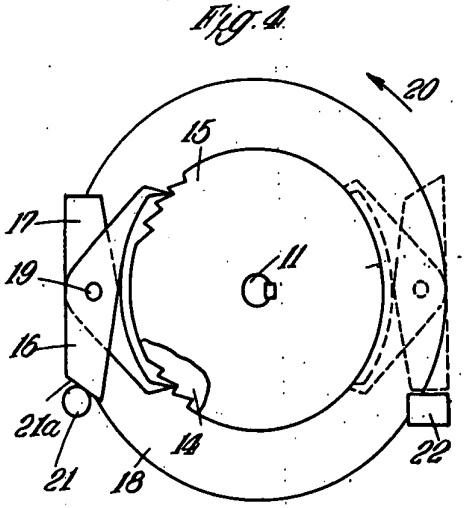


Fig. 4.



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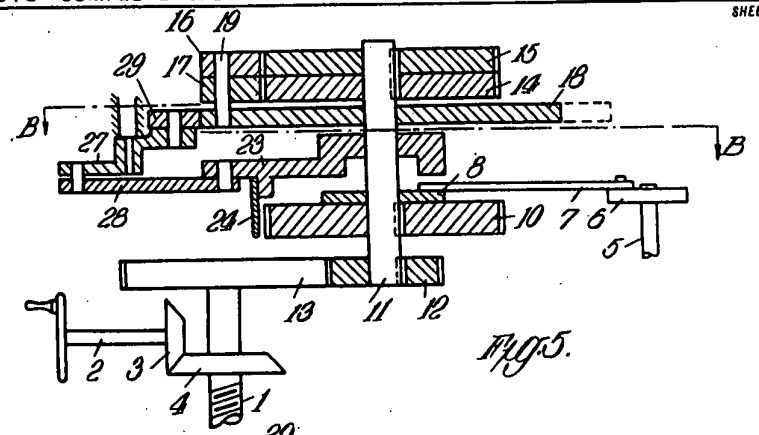

Fig. 5.

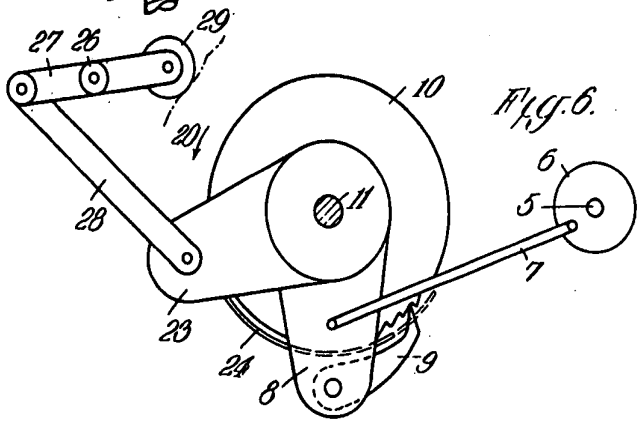

Fig. 6.

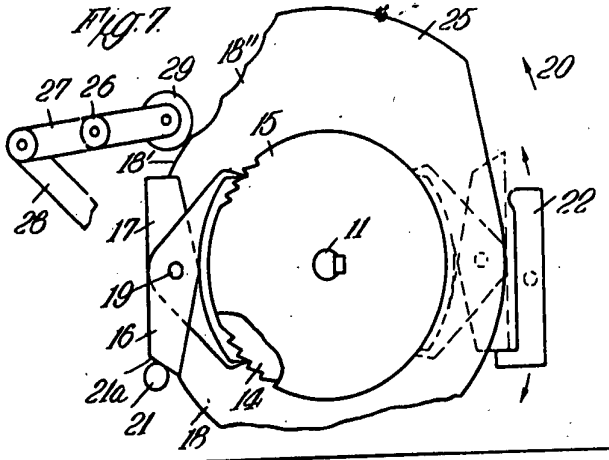

Fig. 7.

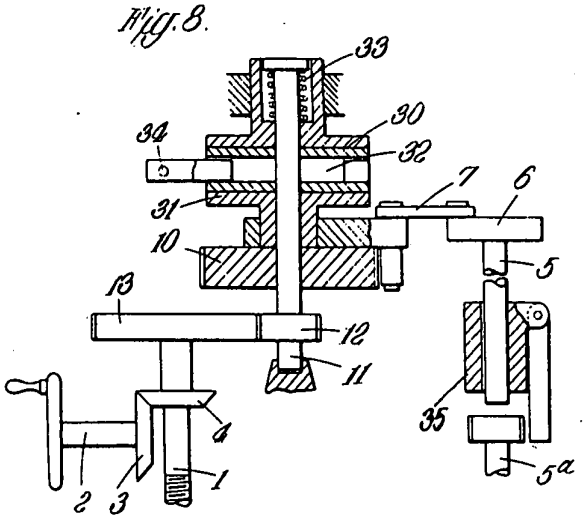

Fig. 8.

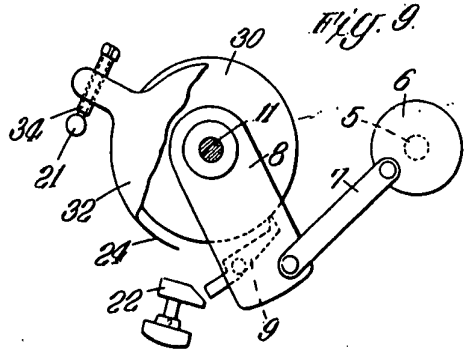

Fig. 9.

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